

Watershed project summaries and the §319 success story.

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Watershed projects and success stories

The number of watershed projects completed in 2021 were limited. The prominent reason was the continuing Covid-19 pandemic, which generates many supply chain issues, shortages of materials and personnel, and significant cost increase in some instances. The completion rate for FFY17 is only 45% ([Table 1](#)), which is lower than anticipated at this point in the cycle. However, the majority of the FFY17 watershed projects are on track to be completed on/before that close of the FFY.

This report highlights two watershed projects; one is an example of agricultural work, and the other is acid mine drainage (AMD) remediation. The continued successes of the Muddy Creek restoration is our 2021 success story.

Below are photos from a few more projects active in 2021. Additional details can be found on USEPA's new [GRITS public portal](#), which is an excellent way to learn more about the \$319 projects in West Virginia and beyond, and by contacting the Program Coordinator. Our 2017-2021 project list and their status are provided in [Appendix 3](#).

Watershed project photos



Stream structures being placed during the early phase of the Morris Creek restoration. Shortly after installation a heavy rain event occurred but the structures remained stable.



For many years MCWA has been able to involve a wide variety of partners and volunteers in their projects and other activities. Unfortunately, when WVU Tech moved from Montgomery, student/teacher participation became much more difficult, and the pandemic hampered efforts even more. However, many dedicated volunteers continued to give their time and effort, some coming from great distances to learn and provide a helping hand.



A plethora of agency partners, students/teachers, residents, and more were involved in the many phases of this project. It was truly amazing how this unique project motivated so many. This is not the end of this effort. There is still more to do, and it is a likely candidate for a future success story.

Piney Creek wetland/stream restoration progression...



Removing/relocating fish



Dredging/dam removal/channel work



Wetland meanders



Successful planting and regeneration

The projects and photos shown here were a few of those highlighted from projects presented during the 2021 virtual tour. The project presentations are available upon request.

Muddy Creek Dream Mountain Project Summary

Organization: FOC

Contact: Madison Ball and Martin Christ

Watershed Information

TMDL Subwatershed: 275 - HUC 12: 50200040703 – Muddy Creek

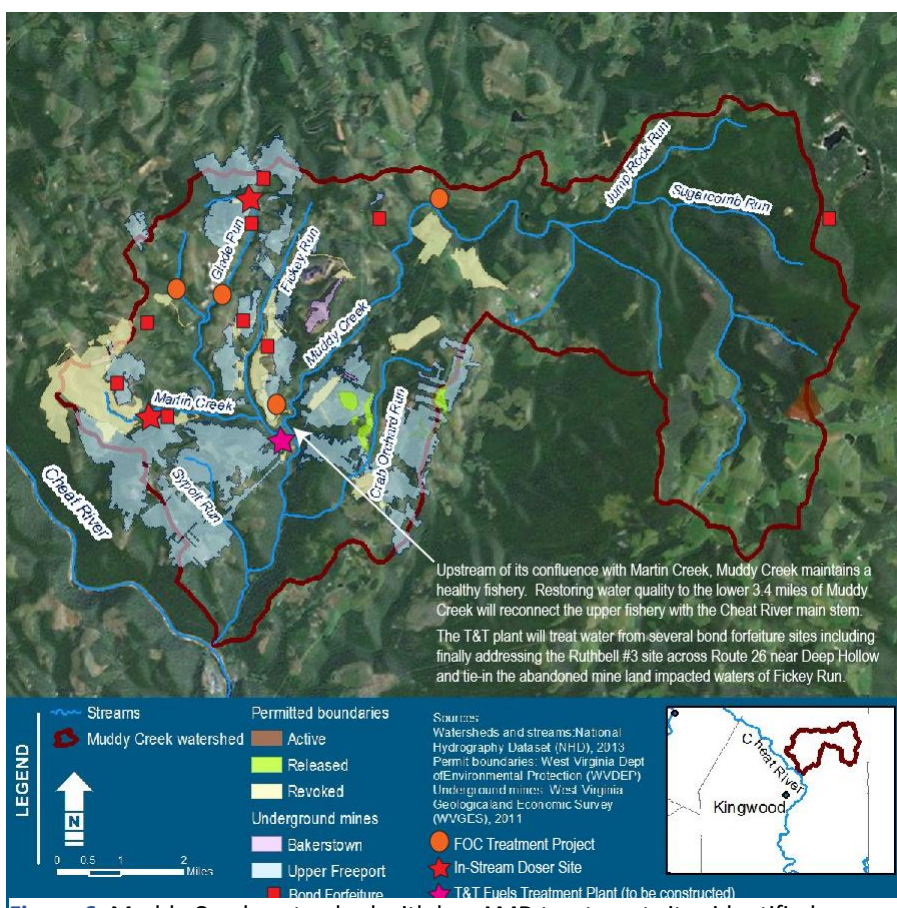


Figure 6. Muddy Creek watershed with key AMD treatment sites identified.

measures are needed on abandoned mine land sites to continue to improve water quality of the Muddy Creek headwaters as well as to the mainstem.

Thus, FOC began a large improvement project to rebuild the “Dream Mountain” Passive Treatment System on Muddy Creek just upstream of Martin Creek. This primary site is the last major source of AMD that drains directly to Muddy Creek. Originally constructed in 2009, the steel slag bed was often dry and did not currently produce enough alkalinity to compensate for the AMD even when it is discharging water.

Project highlights

In September 2019 FOC procured BioMost, Inc. to design passive treatment system improvements at Dream Mountain. The design consisted of converting the existing steel slag bed into a 4,750 ton auto flushing vertical flow pond filled with high quality (90% CaCO₃) limestone, converting the mixing basin to settling pond, and improving the existing connections between treatment components. FOC then procured a construction contractor (Blue Gold Development, LLC) in December of 2020. Project construction went smoothly, and the project reached substantial completion on April 27th, 2021.

Introduction

The Muddy Creek Watershed is a direct tributary to the Lower Cheat River, which is a part of the Monongahela River System. Muddy Creek has historically been considered the most significant source of AMD to the Cheat River system.

FOC has worked collaboratively with federal, state, and local agencies to restore Muddy Creek from the damaging effects of AMD since 1994. WVDEP’s OSR is currently undertaking a new approach (Figure 5) to restore the lower 3.4 miles of Muddy Creek to improve biological connectivity between upper Muddy Creek (a trout stream) and the Cheat River. This approach has had success, and routine data collected at the mouth of Muddy Creek shows that it is no longer the primary contributor to AMD-related impairments and is considered pH-circumneutral.

However, Muddy Creek mainstem is still occasionally outside of the parameters for healthy water quality standards related to iron and aluminum. Additional treatment

Results

Water quality results after over a month post construction show improvements and a 66% reduction in acidity), a 59% reduction in total aluminum, and a 91% reduction in total iron from the system-in to the system-out for the AMD source that feeds the Dream Mountain passive treatment system. However, as expected the recent water quality shows effluent leaving the site (system-out) does not meet water quality standards for pH, aluminum, and iron (Table 8). FOC anticipates improved water quality from the system effluent and improved load reductions (target 80% or greater) after the construction of a Phase II at the project site, which will consist of converting one or both of the manufactured wetland cells into more efficient treatment components, such as a second limestone leach bed or Jennings Pond.

Table 8. Muddy Creek Dream Mountain treatment results.

Site name	Date	pH	Flow	Alk	Acid	Al (total)	Fe (total)	Mn (total)	Totals
DM-SO System out	11-Jun-21	3.54	55.2 cfs	ND	184.5 mg/L	19.5 mg/L	3.96 mg/L	1.84 mg/L	209.8
DM-combo System in	11-Jun-21	2.9	66.1 cfs	ND	455.4 mg/L	39.4 mg/L	34.9 mg/L	2.13 mg/L	531.8

The table above shows recent water quality parameters for monitoring locations for the Muddy Creek Dream Mountain project. ND represents non-detectable, and the total represents a sum of all pollutants except for pH. Note: there is an 86 percent difference between system-in and system-out.

Partners and funding

Most of the funding was secured through the USEPA's §319 NPS Program, specifically NPS1633 (\$326,800) as well as a Department of Interior OSM-WCAP grant (\$100,000). Match was provided by WVDEP-OAML, FOC, BioMost, and volunteer match (\$122,374).



4,750 ton Auto Flushing Vertical Flow Pond filled with 90%+ CaCO₃ content limestone.



Newly dredged settling pond with greater storage capacity.

Indian Creek project summary

HUCs: (050500020701) Burnside Branch

Lead agency/contacts: WVCA (Matt Morgan, John Nelson, Mike McMunigal)

Project location - introduction

Indian Creek in Monroe County of West Virginia is a large tributary of the New River (Figures 6-7). This stream is heavily impacted by cattle and other livestock feeding on karst geology and near karst windows and open sink holes. Agriculture in this area consists primarily of beef cattle and sheep operations with limited dairy production. The goal of this project is to evenly distribute grazing throughout the karst area, spreading nutrients and bacteria laden waste in a manner that will reduce concentrated runoff and infiltration; and

rehabilitate failing septic systems contributing to the bacteria load (Indian Creek WBP, 2017). BMPs included prescribed grazing, nutrient management, livestock water development, pasture division fencing and failing septic system rehabilitation. Alternative water development and division fencing were utilized to implement the prescribed grazing plans.

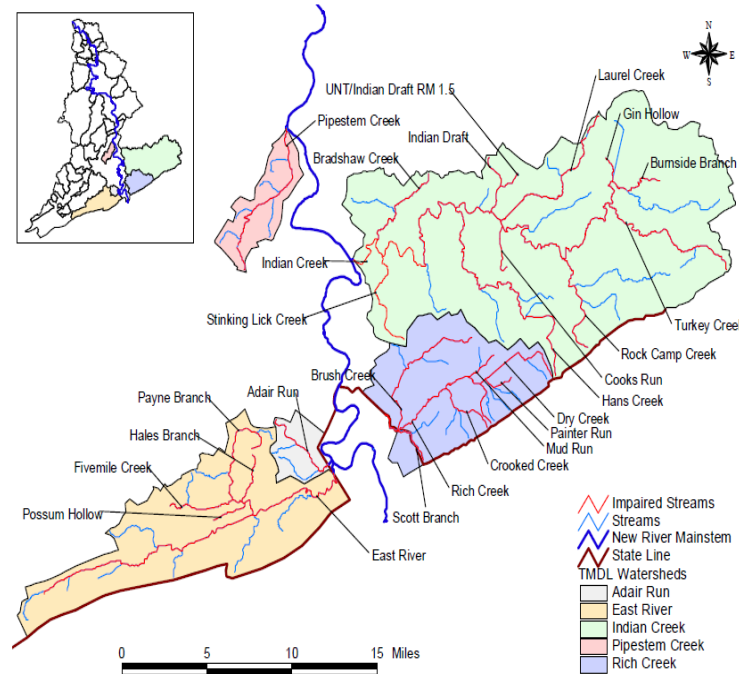


Figure 7: Lower New River TMDL map

Problem

Indian Creek was placed on the 303(d) list in 2006 due to fecal coliform bacteria contamination due to undetermined sources and is included in the 2008 TMDL for streams in the New River watershed (TMDL, 2008). The Indian Creek watershed consists of five HUC12 watersheds (Burnside Branch, Upper Indian Creek, Rock Camp Creek, Middle Indian Creek, and Lower Indian Creek – Figure 7). Projects

associated with this grant focused efforts only within the Burnside Branch HUC12 watershed. Future project proposals (Indian Creek II – NPS 1706 and Indian Creek III – NPS 1781) will continue to focus efforts on Burnside Branch but will also begin to expand to adjacent Indian Creek HUC12 watersheds. The goal will be to continue working in a stepwise fashion, downstream throughout the entire watershed to the confluence of Indian Creek and the New River.

Results

Project results included the development of four grazing plans to facilitate rotational grazing and exclude livestock from streams, sinkholes and ponds, assisting USDA-NRCS staff with project implementation under the NWQI program, conducting a field day in November 2019 at the WVU Willow Bend Demonstration Farm, highlighting projects during the November 2019 EPA tour, providing technical assistance to cooperators, monitoring water quality within the project area, coordinating septic system project planning efforts with the MCHD, and the installation of 33,513 feet of pasture division and exclusion fence. Septic system project participation was low during this grant period due to challenges with outreach efforts; however, participation

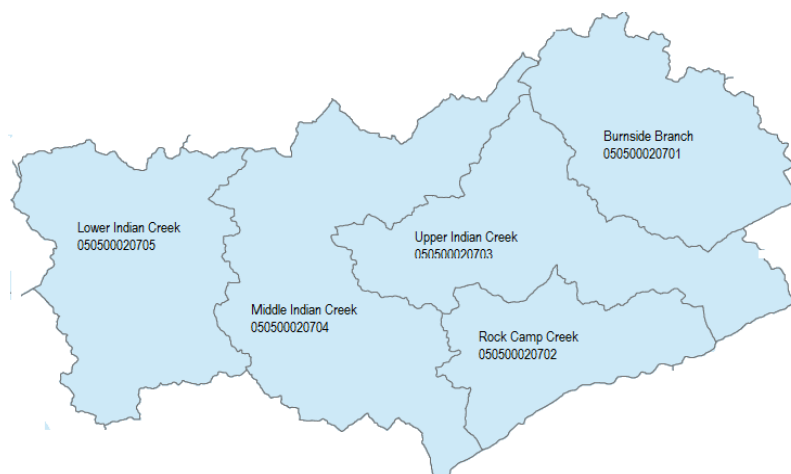


Figure 8: Indian Creek HUC12 watersheds

has increased significantly within the last few months and several septic system replacement and pumping projects have been completed utilizing funding from subsequent grant awards (Indian Creek II – NPS 1706), and more are under contract or in process, and will be completed soon. Due to the low septic program participation and a few fencing projects having not been completed yet, estimated load reductions during this grant period are slightly below expected load reduction goals (Table 9).

Partners and funding

The following were vital partners supporting this \$319 project – WVCA, USDA-NRCS, WVDEP, Monroe CHD, USFWS, the GVCD, and of course local landowners. In addition, the ICRW provided limited monitoring and outreach support and NWQI funding has provided major benefits for all the Indian Creek projects.

Table 9. Project load reductions

Load reduction goal	1.04E+13 CFU
Load reductions achieved	4.69E+12 CFU
Difference	5.71E+12 CFU
Percent difference	75.7

Table 10. Project funding summary

\$319 funds awarded	\$100,000
\$319 funds spent	\$100,000
NRCS-NWQI	(See below)
Match spent	\$73,799
Total spent	\$173,799

NWQI support for all Indian Creek HUCs:

FFY18 (\$479,000), FFY19 (\$411,000), FFY20 (\$280,000), FFY21 (\$35,000)



Stream exclusion fencing with a riparian buffer.



Field day presentation/lunch and fencing demonstration





NONPOINT SOURCE SUCCESS STORY

West Virginia

Muddy Creek Watershed Restoration Projects and Partnership Improve Water Quality of Cheat River

Waterbodies Improved

The lower 3.4 miles of Muddy Creek, a tributary to the Cheat River, has been impaired by acid mine drainage (AMD). The acidity, due to dissolved metals in AMD, severely impacts fish, other stream organisms and the river ecosystem. Muddy Creek failed to meet water quality standards for pH, iron and aluminum, and the Cheat River failed to meet standards for pH and iron. Partners, led by Friends of the Cheat (FOC), a citizens' group, have eliminated most of the pollution loads with passive treatment projects. A new AMD treatment facility provided even more treatment. Fish communities downstream in Muddy Creek now include pollution-sensitive species, such as brown trout. Walleye, which once inhabited the river and were stocked in a lake downstream, are now migrating upstream. Boaters on the Cheat report an improvement in the river and a more satisfying boating experience. ([Visit the story map](#))

Problem

Muddy Creek is a tributary to the Cheat River near the town of Albright in northern West Virginia (Figure 1). The Cheat River drains a rugged, 1,400-square mile watershed in West Virginia and Pennsylvania. It is a destination for whitewater boaters worldwide and has hosted commercial guided trips since 1968.

AMD pollution in Muddy Creek comes from coal mines, where pyrite, a mineral in the coal, oxidizes to form dissolved iron and sulfuric acid, which dissolves additional metals from rock and soil (Figure 2). In 1994, water in a mine void in the T&T Mine Complex “blew out” through a hillside. The AMD polluted not only Muddy Creek but the entire Cheat River, its receiving stream. The blow-out called attention to the need to neutralize hundreds of other long-term AMD sources in the Muddy Creek and Cheat River watersheds.

FOC used U.S. Environmental Protection Agency (EPA) Clean Water Act section 319 funds administered by the West Virginia Department of Environmental Protection (WVDEP) to begin building passive treatment projects for other AMD sources in the watershed.

In the meantime, WVDEP was treating AMD from mines that had gone bankrupt and forfeited their permits. The treated water was good enough to support fish and other aquatic life, but it would flow into

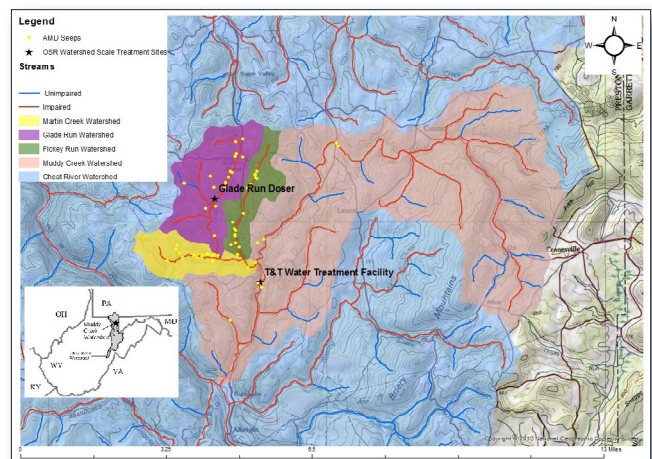


Figure 1. Muddy Creek is in the lower Cheat River watershed in northern West Virginia.

streams that were polluted to a pH level near 3.0 (i.e., acidic) by mines that had been abandoned before the law required stringent permits.

Story Highlights

FOC, formed after the 1994 AMD blow-out, organized efforts for the restoration of Muddy Creek and the Cheat River. FOC secured section 319 funding and installed four passive treatment projects on small-to-moderate AMD sources. They also hold a popular annual river festival and maintain access roads for



Figure 2. Iron-laden, acidic water from Fickey Run, center, discharged into Martin Creek, a tributary of Muddy Creek, before the restoration project.



Figure 3. Greg Short displays a walleye.

boaters. FOC also organized a partnership, called “River of Promise,” with state and federal agencies as well as local citizens and whitewater recreation advocates worldwide. The partnership coordinates resources and advocates for restoration projects. WVDEP, which has been part of River of Promise from the beginning, used its greater resources to finish the

work of improving Muddy Creek and the Cheat River. Under a 2017 water quality variance, EPA approved an innovative permitting strategy that allows for contaminated water flowing from several streams to be treated by an in-stream water doser or conveyed through the AMD water collection system that ties into a new treatment facility. The water is decontaminated using lime slurry, polymers and clarifiers to raise pH and remove the metal substances. Clean water is then returned to the watershed in a continuous flow that dilutes and gradually restores the creek.

Results

Before treatment, in 2015, results from an electro-shock fish survey near the mouth of Muddy Creek showed no fish. In 2019, after treatment had begun, a survey detected 143 fish of nine different species. Median pH values increased from 4.3 to 7.3 following treatment. Since June 2018, Muddy Creek has been net alkaline. Median aluminum and iron concentrations decreased from 10 and 9 milligrams per liter (mg/L), respectively, to 1 mg/L. The median discharge of acidity into the Cheat River decreased from 11,800 pounds per day (lbs/day) to -1,100 lbs/day calcium carbonate equivalent.

Sensitive game fish species, notably walleye, have been caught in the Cheat River closer to the mouth of Muddy Creek (Figure 3). Whitewater boaters downstream from Muddy Creek perceive the improvement as a decrease in turbidity. FOC continues to monitor Muddy Creek through regular water quality and benthic macroinvertebrate sampling, focused on assessing and quantifying watershed improvements from AMD treatment projects in the Muddy Creek watershed.

Partners and Funding

From 2005 through the present, a significant amount of funding has been dedicated to Muddy Creek restoration activities. FOC secured \$837,000 through the WVDEP’s and EPA’s nonpoint source programs. FOC also spent \$407,000 from EPA through a Targeted Watershed Initiative grant. These funds were matched by \$497,000 from the U.S. Office of Surface Mining Reclamation and Enforcement and \$478,000 in state matching funds. Most recently, WVDEP spent \$9 million on AMD treatment plants.



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